The same data are placed in a group fashion because it is easy to combine those data at the receiver. Note that the repeated data can be combined only after *r* (6 in this example) data are available.

The repetition pattern in the above example does not provide the greatest possible frequency diversity since the spacing between the same data transmitted on adjacent subchannels may not be large enough and the subchannels corresponding to the same data are not completely independent. Greater frequency diversity would be desirable especially for multipath channels with large delay spreads. Interleaver 306, therefore, is designed to spread the repeated data in the frequency domain to achieve frequency diversity as much as is practical.

In one embodiment, the interleaver is designed to optimize the frequency diversity provided by the interleaver for data rates faster than 1Mbps (repetition number <=6). For lower data rates ½ and ¼ Mbps, there is enough repetition that sufficient subchannels are covered to provide frequency diversity even if adjacent subchannels are used. In the preferred interleaver described below, repeated bits are separated at least by 8 subchannels and consecutive coded bits from the convolutional encoder are separated at least by 3 subchannels . The interleaver is designed according to the following steps:

1. A 6x8 table is generated as shown in Figure 4A to satisfy the first rule which specifies that bits are separated at least by 8 subchannels.

2. As shown in Figure 4B, the columns are swapped to meet the second rule which specifies that consecutive coded bits are separated at least by 3 subchannels.

3. As shown in Figure 4C, separation between repeated bits is increased by swapping rows. In the example shown, repeated bits are separated by at least 16 bins for 3Mbps (Repetition number=2 for 3 Mbps so each bit is repeated once.)

For the example interleaver shown, if the input to the interleaver is {1,2,3,...,48}, then the output would be: {1, 19, 37, 7, 25, 43, 13, 31, 4, 22, 40, 10, 28, 46, 16, 34, 2, 20, 38, 8, 26, 44, 14, 32, 5, 23, 41, 11, 29, 47, 17, 35, 3, 21, 39, 9, 27, 45, 15, 33, 6, 24, 42, 12, 30, 48, 18, 36}.

Repetition of the values in the frequency domain tends to generate a peak in the time domain, especially for very low data rates (i.e., for large repetition numbers). The large peak-to-average ratio (PAR) causes problems for the system, especially the transmit power amplifier. This problem can be ameliorated by scrambling or masking the values transmitted on different frequencies so that they are not all the same. As long as the masking scheme is known, the scrambling can be undone at the receiver. In one embodiment, the frequency-domain data is multiplied by the long symbol of 802.11a/g, which was carefully designed in terms of PAR. As can be seen in Figure 2, the mask operation is performed right before the IFFT operation. In general, any masking sequence can be used that causes repeated values to differ enough that the PAR is suitably reduced. For example, a pseudorandom code is used in some embodiments.

At the receiver, decoding includes: (1) mask removal, (2) deinterleaving, (3) data combining, (4) channel correction, (5) Viterbi decoding. It should be noted that in some embodiments, the order of the steps may be changed as is appropriate.